THE IMPACT OF WATER SUPPLY ON DIARRHEAL DISEASE IN SEVERAL VILLAGES, NUSA TENGGARA TIMUR

Sumengen Sutomo[1], Zainul Bakri[1], Cyrus H. Simanjuntak[1], Kumoro Palupi[1], Sutoto[2], and Kasnodihardjo[1]

ABSTRAK

Dampak penyediaan air bersih terhadap penyakit diare telah dipelajari di dua kecamatan endemis Malaka Tengah dan Malaka Barat, Kabupaten Belu, Propinsi Nusa Tenggara Timur dalam bulan Nopember 1987. Prevalensi diare di 15 desa berkisar antara 73,9 – 634,2 per 1000 penduduk dengan rata-rata 269,2 per 1000 penduduk. Prevalensi di desa yang menggunakan sarana baik (safe) 166 per 1000 penduduk, sarana kurang baik (less safe) 184 per 1000 penduduk dan sarana jelek (unsafe) 315 per 1000 penduduk.

Sarana penyediaan air mempengaruhi prevalensi diare. Prevalensi diare relatif rendah di desa yang sebagian besar penduduknya menggunakan sarana baik. Sebaliknya prevalensi lebih tinggi di desa yang menggunakan sarana kurang baik atau jelek.

INTRODUCTION

Diarrheal disease is the most important cause of morbidity and mortality in developing countries. It kills at least 4—5 million children every year in Africa, Asia and Latin Amerika.[1]

In Indonesia, diarrheal disease is the main cause of death among infants and the second cause of death among the population.[2,3]. Epidemics of diarrhea frequently occur in several provinces that have caused high morbidity and mortality rates.[4]

To reduce the occurrence of diarrhea, improvement in water supply, sanitation and community health education has been undertaken for several years throughout the country. However, evaluation of its impact has not yet been conducted.

This study was carried out to provide information on the impact of improved water supply on diarrheal disease. The prevalence of diarrhea was compared to identify the impact of water supply.

METHODS

This study was conducted in 2 districts of West Malaka and Central Malaka, Belu, Nusa Tenggara Timur. A sample of 1952 households was selected by a systematic random sampling in fifteen villages, representing 93% response rate. The total population in the sample was 10,720 pessons.

Diarrhea is defined as a condition characterized by an abnormal frequency and liquidity of fecal discharge. It is considered diarrhea when there were more than 3 passages a day of watery, semisolid, liquid or frothy excreta with or without blood or mucus.[6,7].

Water supply is classified into safe, less safe and unsafe water supply. Safe

1. National Insitute of Health Research and Development, Ministry of Health, Jakarta.
2. Directorate General for Communicable Diseases Control and Evironmental Health, Ministry of Health, Jakarta.

water supply is piped systems and protected springs; less safe is artesian wells, deep well pumps and shallows well pumps. Unsafe water supply includes open dug wells, streams, rivers, ponds and reservoirs.

Villages were stratified into those categories where more than 60% of the households had access to one of the water supplies.

Housewives were selected as respondents and they were interviewed to identify the occurrence of diarrhea. Cases of diarrhea were determined using two weeks recall period, and rectal swabs were taken for laboratory examination. Every household was observed to determine type of water supply. Interviews and observations were conducted using questionnaires.

The prevalence rate in every village was calculated, and comparison of the rates was done to identify the effect of water supply. In addition, the proportion of diarrhea was compared to determine the association between water supply and diarrhea. The chi-square test was performed using standard program from the Statistical Package for Social Science (SPSS).

RESULTS

Of the 10,720 persons in this study, 111 were cases of diarrhea. Of the 111 cases, 19% were infants, 53% were children under-five years, and 28% were more than 15 years. The prevalence of diarrhea varied from 73.9 to 634.2 per 1000 population in every village, and the total rate was 269.2 per 1000 population. The mortality rate due to diarrhea was 103 death per 1000 population. The prevalence rate in villages with population which had access to safe water supply was 166.0 per 1000 population; those with population which had access to less safe water supply was 184.0 per 1000 population; and in those with population which did not have access to such facilities was 315.8 per 1000 population (Table 1). The prevalence rate in villages with population which had access to safe water supply was lower than in those with population which did not have access to such facilities.

The proportion of with diarrhea was higher in villages which dit not have access to safe water supply than in those which did have access to such facilities. There is a significant association between water supply and diarrhea in the population ($X^2 = 4,3$ $p < 0.05$). Table 2 shows the proportion of population with diarrhea in villages with respect to water supply.

DISCUSSION

The average prevalence of diarrhea in 15 villages was 269.2 per 1000 population. A morbidity study in semi urban area, Ujung Pandang, South Sulawesi reported that the incidence of diarrhea was 430 per 1000 population per year in 1973.[9]. A prospective study in North Jakarta in 1981 revealed that the morbidity of diarrhea was 149 per 1000 population.[10] Comparing with the previous figures, the prevalence of diarrhea in this finding was not much different. Moreover, the distribution of cases was similar to the national figures reported by the Directorate General for CDC & EH and the previous investigators that more than 60% of the cases were children under five year.[5, 8, 9, 10, 11].

Tabel 1. Prevalence of diarrhea in villages with respect to water supply

Village	Population	Prevalence rate per 1000 population Case	Rate	Average
Safe				
Haitimuk	563	2	92.4	166.0
Kateri	760	7	235.5	
Less Safe				
Webrimata	619	7	294.0	184.0
Umalawain	704	2	73.9	
Unsafe				
Fahiluka	779	9	300.4	315.8
Naimana	533	13	634.2	
Kletek	1,060	16	392.5	
Umakatahan	834	10	311.8	
Kaimanesa	441	2	117.9	
Alkani	625	7	291.2	
Weoe	1,645	12	189.7	
Besikama	338	3	230.8	
Motaulun	926	12	331.9	
Maktihan	615	4	169.1	
Wederok	258	5	503.9	
Total	10,720	111		269.2

Table 2. Proportion of population with diarrhea with respect to water supply

Water supply	Population of sample	Diarrhea (%)
Safe	1,323	9 (0.7)[a]
Less safe	1,323	9 (0.7)[b]
Unsafe	8,074	93 (1.2)[c]
Total	10,720	111 (1.0)

a vs b X^2 0.0 p $>$ 0.05 (a + b) vs c X^2 4,3 p $<$0.05
a (b) vs c X^2 2.4 p $>$ 0 05 overall X^2 4,6 p $>$0.05

This relationship between water supply and diarrhea suggest that the reduction of the prevalence of diarrhea in several villages was due to improved water supply. In the village of Keteri, Wibrimata, Umalawain and Haitimuk most of the population had access to safe or less safe water supply and also had lower rates of diarrhea than those which did not have access to such facilities.

The protection of water supply has prevented the source of water from being contaminated by wastes disposal including human, animal, and domestic wastes. These wastes are very dangerous to human health since they often transmit water related diseases such as diarrheal disease. On the other hand, people who did not have access to protected water supply were at risk of having those infections. Azurin and Alvero in 1974 reported that the provision of safe water supply reduced 73% of cholera cases. [12] Similar findings by Sneider et al. (1978) demonstrated that water supplies had a positive impact on reducing diarrhea except for few and very specific situations, such as water borne diseases, the importance and effectiveness of water supply was not known. [13]. Many other studies indicated that diarrhea could be reduced through the provision of protected water supplies. [14.10.16,]

The findings also demonstrated a significant association between water supply and diarrhea. The population in villages which had access to safe water were more likely to have lower diarrhea rates than those which did not have access to such facilities. This finding was similar to that previously reported by Sutomo et al, in 1987.[19]

In conclusion the improvement in water supply in villages would reduce the prevalence rate of diarrheal disease. The people who had access to safe water supply have lower rates of diarrhea transmission than those who live in areas with limited access to such facilities.

Finally, it is suggested that the improvement in water supply should consider a priority in the endemic diarrhea and reach a high coverage to the target population.

ACKNOWLEDGEMENTS

This study was supported by grant from the WHO Project INO RPD 001 1986. We are grateful for the support. We wish to acknowledge Prof. Dr A.A. Loedin, former Head of the National Institute of Health Research and Development for his support to this study.

We also thanked L. Lada MD, Head of the Provincial Health Service, Felicianus Payung Pria MD, Head of the Regency Health Service, Drs. Cecep and all their staff who participated actively in this study. Finally we thank Robert Tilden MPH, Dr. PH for reviewing the paper. Without their contribution this study would not be completed.

REFERENCES

1. World Health Organization (1984). Programme for control of diarrheal diseases. *Manual for the health planning programmes.* WHO Geneva. 3.
2. Budiarso L. Ratna (1983). Sebab kematian bayi dan anak balita. Survei Kesehatan Rumah Tangga 1980. *Bul. Penelit. Kesehat.* 11 (1) 1983 : 1 – 4.

3. Budiarso L. Ratna et al (1986). *Survai Kesehatan Rumah Tangga 1986*.Badan Penelitian dan Pengembangan Kesehatan, Puslit Ekologi Kesehatan, Jakarta : 1--69.

4. Simanjuntak C.H. et al (1983). Etiologi microbiologís penyakit diare akut. *Bul. Penelit. Kesehat.* 11 (2) 1983 : 1 — 9.

5. Sub. Dit. P2 Diare. Ditjen P2M & PLP (1986) Kecacingan dan Parasit Perut. *Umpan balik hasil pemberantasan Penyakit diare tahun 1984 — 1985*. Ditjen. PPM & PLP. : 1—20.

6. International Bank of Reconstruction and Development, International Development Association, Public Utilities Department (1976). Notes Series. Measurement of the health benefit of investment in water supply. *Report of an expert panel to the IBRD*, May 5—7 , 1975. PU Report No. PUN 20. 4 —10.

7. Rajagopalan P.R. Dit and K.A. Pisharoti (1976). Impact of water supply on the incidence of diarrhea and shigellosis among children in rural community. *Madura Indian J. Med. Res.* 66(2) : 189—199 .

8. Sutomo Sumengen et al. (1988). Sarana air bersih, sanitasi dan diare di kabupaten Belu. NTT. Laporan akhir. Departemen Kesehatan, Badan Penelitian dan Pengembangan Kesehatan, Jakarta : 1 — 46.

9. Brotowasisto (1975). Epidemiologi penyakit diare. *Seminar Rehidrasi Nasional I*, Jakarta, 26—29 Agustus 1974: 20 — 26.

10. Sutoto et al. (1982). Morbidity and Mortality on diarrheal diseases in North Jakarta. An urban area. *SEA J. Trop. Med. Publ. Health* 13 (3). : 405 — 411.

11. Sutomo Sumengen (1987). Diarrheal diseases in rural areas of Indonesia *Maj. Kesehat. Masy. XV (4) Jan. 1988.*

12. Azurin J.C. and Alvero M. (1974). Field evaluation of environmental sanitation measures against cholera. *Bull, World Health Organiz.*, WHO, (51) : 19—26

13. Schneider R.E.: Shiffman M. and Faigenblum J. (1978). The potential effect of water on gastrointestinal infections prevalent in developing countries. *Am. J. Clin — Nutr.*(31) : 2089 — 2099

14. Pournadeali E.; M. Bay Tay (1980). Potable water and village health. Is primary and prevention affordable?. *Publ. Health Report*, 95 (3) 1980 : 291 — 294.

15. Freij L. Sterkky G.; Wadstrom T. and Wall S. (1979). Child health and diarrheal diseases in relation to supply and use of water in African Communities. *Great Britain IA WPR. Prof. Wat. Tech.* 11 (1/2) : 49 — 55.

16. Braddley R.M. (1980). Basic sanitation in developing countries. Survey of water use in a low income urban area in the middle EA. *Royal Soc. Health J.* 100(1) 1980 : 67 — 71.

17. Sutomo Sumengen (1987). Water supply and diarrheal diseases in rural areas of Indonesia. *Bul. Penelit. Kesehat.* 15 (2) 1987 : 9 — 14.

* * *